RUPTURE OF THE UTERUS.

An Analysis of Cases treated in the Royal Maternity Hospital during the last twenty-five years.

by

W. K. McIntyre, M.C., M.B., Ch.B.

Thesis for the Degree of M.D. – 1919.

I N T R O D U C T I O N.

A case of Rupture of the Uterus during pregnancy was admitted to the Royal Maternity Hospital in April of this year, which presented many points of unusual interest. A detailed investigation was made by the writer into the clinical history and pathological conditions present in order to discover the cause of the rupture and to elucidate certain points that obscured diagnosis.

A careful search was made through the literature on this subject for a parallel case without success, though here and there cases had points of resemblance. The cases of complete rupture of the Uterus that had occurred in, or had been admitted to, the above hospital during the last twenty-five years were also examined, and it was thought that as complete an analysis as could be made from the hospital records, would be of interest and value. These cases cannot of course be described in the same detail as has been done in the case that came under the writer's care as House Surgeon, but though the work of searching through the hospital records has been tedious, many interesting facts and figures were discovered and are presented below.

The/

The latest case will be described and commented on first, and then the analysis of cases of the previous 25 years will be given and summarised.

I have to thank Dr Haig Ferguson, F.R.C.S., etc., for permission to use the hospital records and Case No.12, and also for his courtesy in allowing me access to the library of the Royal College of Physicians.

Case of Rupture of the Uterus admitted to the Royal Maternity Hospital on 19.9.19.

The case is as follows:-

Mrs K. aged 34, a para IX with five living children. Oldest aged 12 and youngest 3 years. She had had no miscarriages. One died at 2½ years from pneumonia, one at 10 months from measles and one was born dead in January 1915. The latter was a district case and was conducted by nurses from this hospital. The entry records that this was a vertex presentation L.O.A. position, and that there was some trouble in delivering the shoulders. Forceps were not used. In January 1916 she had a living child and no history can be obtained of any special trouble in this or in any of her 8 confinements, of the use of forceps, or of manual removal of the placenta. There was no history of curettage nor of puerperal fever. In fact all her previous confinements seem to have been easy and peculiarly free from interference.

Her husband was killed in France in April 1917. She again became pregnant in the middle of 1918, her last menstrual period being at the end of June 1918. Because of the fact that this was an illegitimate child/

child and the woman was obviously ashamed of her condition, and may not have given a straightforward account of her last pregnancy, great pains were taken to get as complete a history as possible from her relatives and neighbours, and these have in most essentials confirmed her own story.

History of Pregnancy.

With the exception of an attack of influenza in the middle of the winter, when she was confined to her bed for some days, and was troubled with a subsequent cough for many weeks, there was nothing eventful about her pregnancy until the beginning of April, when there is a story, which she did not herself give, of a fall against a table in her house. She seems to have made a jest of this to her neighbours, and it certainly never interfered in any way with her work. Her eldest son however says that she was not so well after this time. She did not lie up, but carried on her ordinary household work without complaint. Several times a week she did a morning's washing at the public wash house and afterwards carried the wet clothes up the three flights of stairs to her room. This she did on the day before she was admitted to hospital.

She herself said that seven days before she was admitted, she slipped as she was going downstairs and sat/

sat rather heavily on her buttocks, but got up immediately and felt no ill effects whatever either at the time or later. The facts that she had no abdominal crisis prior to the day she came into hospital, that she never at any time in the last two months took to her bed, and that she was doing heavy work and constantly climbing long flights of stairs, are emphasised as being of importance when viewed in the light of subsequent findings. About 4 a.m. on April 19th, the patient felt what she thought were the "waters" coming away and she called in her neighbour. This woman found the patient sitting on the edge of the bed with pools of blood in the bed and on the floor. Bleeding had then stopped. The exterm doctor was called who on arrival found the patient suffering from profound shock, - temperature 95°, Pulse 75 feeble and easily compressible, skin cold and clammy; she was extremely anaemic, restless and anxious, and vomited frequently. There were a few clots in the vagina, the os admitted two fingers, membranes bulging and head presenting. External bleeding had ceased.

The abdomen was the size of a full term pregnancy without undue tension and there was no tenderness. She had no abdominal pain and it was considered that there was no concealed haemorrhage taking place. She had not had any labour pains. While waiting for the Ambulance/

Ambulance the usual treatment for haemorrhage and shock was carried out, but patient did not respond, and her condition was so bad that it was considered whether she should be moved at all.

State on admission.

Patient arrived at hospital in an almost moribund condition - Temperature 96°, pulse 112 and hardly perceptible at the wrist. She was cold and pallid with cyanosed lips and extremities.

Examination of Abdomen.

There had been no alteration in the size of the abdomen since it was first examined. There was a small area of slight tenderness to the left of the umbilicus, but there was no tension and no pain. Two inches above the umbilicus a faint yellowish stain of the skin, which may possibly have been a disappearing ecchymosis, was seen. The head could be felt presenting and apparently engaged in the brim. The uterus seemed flabby and no contractions were felt.

Percussion. There was no evidence of free fluid in the peritoneal cavity.

Auscultation. No foetal heart beats and no souffle were heard.

Vaginal/

Vaginal examination.

The os was found to be dilated to five shillings, through which the membranes were bulging. The head could be felt presenting but no sign of a placenta praevia. Bimanually the foetus was made out to be in a normal position, and only one mass was distinguished - i.e. the foetus. There was no further bleeding. The membranes were ruptured and the vagina packed, in the hope that this would stimulate the uterus to contract and overcome the inertia that had set in. An average quantity of liquor amnii escaped.

Attention was all the time directed to treating the shock and collapse by the usual methods. Dr Haig Ferguson saw the patient in the afternoon and he considered that the patient's condition contra-indicated active measures to deliver the foetus, which was presumed to be dead. Patient had had no pains during the day and no progress in labour had been made. He found the os to be about the same size as in the morning, and the head was felt presenting. Abdominal tension was the same as when admitted, and there was no increase in tenderness, or alteration in its contour. Her general condition had improved a little, - vomiting and thirst were less urgent, though the patient could not retain anything in her stomach, and her pulse was regular, 125 p. m. and of low tension.

It was thought that the profuse external haemorrhage that had occurred was quite sufficient to account for her collapsed condition and for the uterine inertia. She was put on $\frac{1}{2}$ cc. pituitrin every three hours to tone up the uterine muscles and prevent concealed haemorrhage and possibly to bring on labour. The evening temperature had risen to 100° and pulse dropped to 76. Her bowels had not opened since admission. She had a restless sleepless night and complained of great thirst. Next morning her temperature was normal but her pulse had risen again to 130. During the day her condition improved; the pulse was still rapid but of better volume. Vomiting was easier and caused less distress. A slight oozing of blood from the vagina was just sufficient to soak the pad once during the day. Rectal salines and stimulants were continued, and patient remained about the same for the next two days. She slept at intervals, and was able to take a little liquid food by the mouth. Bleeding had stopped, but pituitrin had apparently no effect whatever on the uterine muscle which seemed to be thoroughly disorganised.

Supposing this state of extreme inertia to exist, interference and delivery per vias naturales could not be entertained until the uterine muscle had recovered tone. The alternative of Caesarian section was discussed/

discussed, but the patient's condition was still so bad that her chance of surviving the operation seemed a remote one. On the 4th day a further complication was added by the development of a cough with pain in the left side. There was a suspicious patch with crepitations at the base of the left lung. Temperature rose to 101° and pulse to 140, and there was more oozing from the vagina. Poulticing relieved the pain in the chest and physical signs cleared up during the next forty-eight hours. Rectal salines were persevered with and patient was now taking food by the mouth and retaining most of it, though she vomited occasionally. The urine was carefully examined daily, catheter specimens being taken, but there was never any trace of albumen found. On one occasion only - the fourth after admission, - a considerable amount of albumose was present.

There had been very little alteration in her abdominal condition during these days. She almost always lay on her right side, and on inspection of her abdomen, a rather more marked asymmetry was now to be seen than had been the case at the first examinations; This was caused by a slightly increased fullness on the right side. The slight tenderness on the left of the umbilicus had now passed to the right side, but there was no pain, and apparently no indication for immediate operation. A week after admission patient's general/

general condition showed little improvement, if any, and she still vomited now and then. Her pulse remained at about 120 but was stronger. Temperature on this day rose in the evening to 103° and patient became restless again. She had had no abdominal pain since she came in and pituitrin had apparently had no useful effect, as the uterus seemed as inert as ever.

On the following day Dr Haig Ferguson called in Sir Halliday Croom for a consultation. At this examination the slight asymmetry of the abdomen was still present, as was also the tenderness over the same area. On vaginal examination Sir Halliday found the os now quite closed but the head could be felt presenting. There was a little more fullness in the right as compared to the left lateral fornix.

The patient's general condition had remained practically stationary for the last few days. She worried about her children and thought she was well enough to be sent home again. There had been no sign of foetal life since admission and she had not had any pains suggesting that the uterus was recovering tone.

Sir Halliday advised and Dr Haig Ferguson concurred, that patient's only chance of recovery - a slender one, - lay in Caesarean section and probable hysterectomy./

hysterectomy. This was fixed for the following day and in the meantime patient was put on strychnine $\frac{1}{60}$ and digitalin $\frac{1}{100}$ four hourly. The operation was carried out by Dr Haig Ferguson assisted by Dr O. Nicholson. Chloroform was given in preference to ether because of the lung condition.

Operation.

On opening the abdomen it seemed at first as though the anterior wall of the uterus had become firmly adherent to the abdominal wall, and an unsuccessful attempt was made to separate the adhesions. An incision was then made through what was thought to be the anterior wall of the uterus. The cavity beneath was found to be filled with a dark coloured sanious and rather offensive fluid which welled over the edges of the incision. The body of a macerated full term foetus together with the placenta lay free in this fluid. The placenta was on the right side behind the foetus. The uterus, about the size of full term foetal head, was found lying firmly retracted directly behind the foetal trunk. It had thus been protected from palpation. The foetal head was still retained in the lower uterine segment, the trunk of placenta having escaped through a rent in the anterior wall of the body. The foetus was removed with some difficulty as/

as the head was firmly gripped by the retracted muscle. It was a vertex presentation L.O.A. position. The edges of the rupture had closed down firmly on the neck of the foetus when the body was expelled into the abdominal cavity. What had at first been mistaken for the wall of the uterus when the abdomen was opened, was now seen to be the parietal peritoneum enormously thickened. In parts this measured half an inch, and was nowhere less than one third of an inch, in thickness. Above and behind, the intestines were walled off by a protective layer of organised lymph, the sac wall being here about one eighth of an inch in thickness. There were no gross adhesions between the coils of the intestines, nor was the peritoneum thickened in the same way as the parietal peritoneum. The patient's condition had become very bad and a rapid supra vaginal hysterectomy was performed. The cavity was swabbed out, an attempt made to stitch the brittle edges of the thickened parietal peritoneum together, and the abdomen was closed as quickly as possible. Intra venous saline was given, and injections of pituitrin and strychnine hypodermically and the patient put back to bed. She never rallied however and died a few hours later.

Pathological/

Pathological findings.

The Cord. The cord which was round the neck of the foetus was swollen and undergoing red degeneration.

The Foetus was full term and appeared to be large, but weighed only 7½ lbs. The head was very soft and pulpy, considerably swollen and sutures wide. The body was very macerated, most of the cuticle having peeled, and the abdomen was distended and greenish in colour. It appeared to have been dead some time.

Uterus.

Macroscopic. Size of body after removal - 5" wide and 5" high, and thickness of walls ¾" to 1".
The rupture extended from the right at the junction of of the lower uterine segment with the body, obliquely upwards across the anterior wall to the height of the left fallopian tube, and then down to the left broad ligament 1" below the junction of the tube to the uterus. The edge was raised into a firm semicircular ridge which had gripped the neck of the foetus. There was very little signs of inflammation of the peritoneum covering the uterus. A flap of peritoneum and muscle was adherent to the left fallopian tube, the fimbriae being matted down to the uterine wall. Inside the shaggy placental site was on the posterior wall and

so/

so was not concerned with the rupture.

Microscope.

Section from the edge of the rupture. This shows in the greater part of the section the fibro muscular uterine wall. The muscle is normal in appearance but comparatively scanty in amount as compared with the large amount of fibrous tissue. The muscle does not show any fatty or hyaline degeneration. The fibrous tissue is normal in appearance. On the peritoneal surface there is some adherent lymph which is undergoing organisation. A few round cells can be seen invading the lymph. There is certainly an excess of fibrous tissue compared to the normal myometrium.

Section of Uterus taken from the posterior wall away from the rupture.

1. It shows muscular tissue well developed and of normal appearance in the wall of a large blood vessel (artery). Elsewhere it is small in amount and most of the section consists of

2. Fibrous tissue with numerous well developed blood vessels. Here and there a good deal of blood extravasation has taken place amidst the fibrous tissue. This fibrous tissue is somewhat structureless in appearance and between the fibres are large clear spaces filled with a clear substance, or in some places empty.

So/

So that the fibrous tissue appears to be undergoing degeneration - (myxomatous?) It is interesting to observe that some of the larger vessels are filled with partially or almost totally organised thrombi.

Section from the interior wall of the Uterus at the placental site.

It shows

1. Compact decidua.
2. Spongy decidua with numerous uterine glands in cross and longitudinal section intermingled with decidual cells.
3. Uterine muscle and fibrous tissue. It is normal in appearance.

Section of thickened perietal peritoneum.

There are several layers of organised fibrin in various stages of development. Some layers consist of young and delicate and very cellular fibrous tissue with numerous thin walled blood vessels. The wall of the blood vessel consists of a single layer of flattened endothelial cells, but a few of the larger and better formed vessels have a thicker and stronger wall formed by condensation of the surrounding fibrous tissue which in the wall of the vessel still retains its cellular appearance. At some parts of the section the tissue is mainly fibrin that is being invaded by numerous/

numerous round cells, - the early stage of organisation.

Sections were also examined of the liver, kidneys, heart, and spleen, but beyond a little cloudy swelling in the epithelial lining of the kidney tubules, none of these showed any abnormality.

The Placenta was of average size and weight. On section it was found that a large infarct involved about a quarter of the maternal surface. The rest of the maternal surface appeared normal and did not seem to have been long separated. It was not offensive.

C O M M E N T A R Y.

There are several points of unusual interest in this case.

1. When did the rupture take place? There can be no doubt that the accident had occurred some time - probably weeks - before the haemorrhage which made her send for assistance. In the first place the foetus was so macerated and degeneration had gone so far that it looked as if it had been dead two or three weeks. This alone however would not be a very reliable guide for we have often seen early maceration in a foetus that was certainly alive within/

within one or two days of delivery. A case in point was our last placenta praevia (marginal). At 10 p.m. she was admitted and packed. The foetal heart was very easily heard in the R.O.A. position by myself and verified by the exterm resident surgeon. At 6 a.m. next morning a bipolar version was done and a leg brought down. She delivered herself at 1 p.m. the same day of a full term apparently macerated foetus. The head was softer than normal, and the skin was peeled from parts of the neck, abdomen, buttocks and legs, leaving the usual red patches. The abdomen was rather swollen, and to all outward appearances the foetus might have been dead for several days. Whether maceration can advance so far within a few hours (version was done seven hours before delivery), or whether the placental circulation can still be maintained in spite of early peripheral degeneration of parts of the foetus, I cannot venture to say, but one or the other must have been present in this case.

The real proof that a foreign body had been in the abdominal cavity for more than a few days lay in the condition of the parietal peritoneum, and the sac which enclosed the foetus. The several layers of fibrin which had had time to become well organised and the thickness of the enclosing/

enclosing sac proves this. Organisation of the exudates and blood in the tissues of the wall of the uterus at the edges of the rupture was well advanced. On the other hand unless the foetus had gone on developing in the peritoneal cavity, which is certainly possible, there is a limit set by the fact that the foetus was certainly full term. According to her dates she was due in the first week of April - nearly three weeks before she was admitted to hospital, and it was during this week that she had the first of the two slight accidents spoken of in the history. Whenever rupture took place, and whatever the cause, it must have taken place very quietly, for the membranes were not ruptured.

2. What was the cause of rupture? It was certainly a case of rupture during pregnancy for she had not had any labour pains at any period.

(a) If spontaneous was it due to degeneration of the muscle tissue, or to the rupture of an old cicatrix?

The excess of fibrous tissue found in the section taken from the edge of the rupture might very well have been formed after rupture had taken place. There was invasion of cells, and organisation of lymph and blood had been going on. But this/

this excess was also found in the section from the posterior wall, and it is fair to assume that the musculature of the whole organ had suffered changes. Though no history was given, it is possible that she had suffered from a chronic endometritis and that this had lead to the formation of an excess of fibrous tissue throughout the wall. Of course a much stretched multiparous uterus might become weak and predisposed to rupture by thinning and separation of the muscle fibres without showing fatty or hyaline degeneration. But it would require an extreme degree of degeneration to allow a uterus to give way merely from distension by the growing foetus, or even by excessive amniotic fluid - which was not present.

(b) The alternative is traumatic rupture and there were two accidents which might possibly have been responsible. Three weeks before admission she is said to have fallen against a table, and the remnants of a bruise on her abdomen give colour to the story. This would be a "Direct" injury. It could not have been a severe blow for she went on with her work, and evidently was not seriously distressed by it.

The second fall occurred a fortnight later when she slipped and sat rather heavily on her buttocks,/

buttocks, but at once got up and walked upstairs again. If this was responsible it would be classified as an "Indirect" injury. If rupture had already taken place it is remarkable that this strain did not rupture the membranes. The protective sac may have already been formed and thus protected the amniotic sac.

I am of opinion that both degeneration and trauma were factors responsible for the disaster. The blow must have been slight, but acting directly on a thinned out weakened uterus, it was sufficient to start a rupture which must have proceeded quietly and without causing very great pain. If this is true the rupture took place nearly three weeks previous to her admission to hospital.

3. There was no history given of any haemorrhage before the severe onset which was the cause of her admission. The rupture certainly caused no abdominal crisis, and haemorrhage if present must have been slight. None of the classical symptoms of rupture were present. For three weeks she went about her work which included some hours at the wash tub several times a week, and carried heavy weights up three flights of stairs without complaint or apparent distress.

The final haemorrhage on the 19th April was probably/

probably caused by the complete separation of the placenta, which was then expelled into the abdominal cavity where it was found at the operation.

4. Special points about the case which obscured diagnosis.

(a) History. There was nothing in the history to excite suspicion of rupture. Even the accounts of the accidents made light of them. She had not had any labour pains, and she had not had any abdominal crisis or history of collapse previous to the bleeding.

(b) Symptoms. The symptoms of shock and collapse, her restlessness, feeble pulse, pallor, etc. were fully accounted for by the severe haemorrhage, and indeed were actually due to this and not to the rupture itself. A diagnosis of antepartum haemorrhage, (whether accidental or unavoidable could not be discovered), with the possibility of concealed haemorrhage kept in mind, was quite legitimate, without looking for further complications.

(c) Signs. Examination of the abdomen did not reveal any easily palpable foetal parts. There was a little tenderness in one area, and concealed haemorrhage was thought of. The uterus lay well behind/

behind the foetus, and this alone would have hidden it, but in addition the thick sac acted as a barrier. It was impossible to palpate it.. If the patient had been examined soon after the rupture, no doubt a correct diagnosis would have been suggested from abdominal palpation.

Even at that early stage, however, the uterus would not have been felt as a mass separate from the foetus, for the foetal head was fixed in the lower uterine segment, and would not be capable of lateral movement.

Vaginal examination.

The os was semidilated at first, the unruptured membranes bulging through it. The foetal head firmly fixed could be felt presenting just inside the brim. There was some slight oozing of blood, but the head being down and fixed, it was impossible to diagnose rupture from vaginal examination.

It will be granted that neither from the history nor from the signs or symptoms could a diagnosis of rupture of the uterus be made. Further, the immediate collapse was caused by the severe haemorrhage, due probably to the final separation of the placenta, and this was quite sufficient/

sufficient to account for all the signs and symptoms present.

The occurrence of proteose in the urine while the patient was in hospital is of interest. Koetritz[1] long ago tried to prove that its presence was a sign of foetal death in utero. He stated that it arises from absorption of the products of involution of the muscular organisation of the uterus, and that it is found normally in the puerperium. After death of the foetus the uterus is practically in the puerperium, though the contents are not expelled. He stated that after expulsion of the dead foetus no proteosuria is again found, as the uterus has already gone through the puerperal changes.

This theory has been proved false and of no value by Ballantyne and others, since proteose can often be found in the urine when the foetus is alive in utero. It is however often present in toxaemias, and is sometimes found in patients with threatening eclampsia. In some of our worst cases of the latter, there has been little or no albumen, but a large amount of proteose in a urine of low specific gravity - 1010 - 1015. We have been inclined to regard with increased anxiety a case with such a urine. In this case the proteose was a sign of the toxaemia present.

A/

A careful search has been made through the literature of the subject for a parallel case to this. Though here and there cases are described in which spontaneous rupture occurred without early signs and symptoms of collapse, and one or two in which the patient was able to carry on with her work in spite of a ruptured uterus, no case can be found where diagnosis was obscured by such an interesting combination of unusual conditions. References have been found to a few gynecological cases in which a false sac had been formed, but even in these the amount of thickening and organisation was much less than in the case under review.

A case however of special interest in this connection was admitted to this hospital in 1912, and is worth quoting for it also had a false sac formed round the foetus.

Mrs Mc A. Aet. 25. This was a case of a ruptured ectopic gestation which went on developing in the peritoneal cavity to 8½ months, when the abdomen was explored. An adventitious sac, probably of organic lymph, had been formed round the foetus. The sac was probably membranes with effused lymph. The placenta was in the pouch of Douglas and had been felt per vaginam as a tense globular swelling. Life had been felt

at/

at 7½ months but not since, and the foetus was dead at the time of operation. It weighed 3½ lbs. There was a history of an undiagnosed abdominal crisis at 2½ months, and pains and a feeling of unfitness during the whole pregnancy.

The fact that now and then the uterus may contract down behind the foetus after the total contents have been expelled into the abdominal cavity and so be obscured, is referred to by Munro Kerr[2] and others. Some cases have been reported where the foetal sac has not been ruptured, and the foetus enclosed in its membranes has been wholly or in part in the abdominal cavity.

Campbell[3] reports a case in which the foetus, with membranes enclosing it entire, had been expelled through the rupture of an incarcerated retroflexed uterus. There was no haemorrhage from the laceration and the body of the uterus had contracted well down.

Several cases of quiet opening up of an old Caesarean Scar through which the unruptured foetal sac has been expelled are reported. Oastler[4], Swayne[5], Stookes[6] and others report such cases. Lewes Graham[7] has described three cases of his own.

So many cases have been reported in which rupture has taken place without immediate collapse, that most text books are now inclined to suggest that classical symptoms/

symptoms are rather the exception than the rule. But in the great majority collapse sets in within a few hours, and very few cases can be found where the patient has carried on for days or weeks with her ordinary work: Kubacki[8] tells of a patient of his whose uterus ruptured during pregnancy, and who carried on, but in this case the rupture took place between the layers of the broad ligament and was thus extra peritoneal.

A somewhat analagous case to that under review was described by J. Phillips[9]. In his case there was a definite history of trauma, the woman when seven months pregnant falling from a height of twelve feet on to her buttocks. There was no abdominal crisis and no external bleeding until eight days after the accident. The patient was nursed in bed and kept under observation for ten days. When sent to hospital ten days after the accident, diagnosis of rupture of the uterus was at once made. The foetus could be easily palpated, and the uterus felt as a separate swelling. No presenting part was felt on vaginal examination, and a sound was passed and felt immediately beneath the abdominal wall. At the operation the foetus was found macerated and lying completely outside the uterus among the intestines, together with the placenta. There was a long irregular/

irregular tear in the anterior wall of the uterus and the retracted edges were sloughing. No adventitious sac had been formed.

A.B. Davis[10] described a case of rupture through an old Caesarean scar where the foetal head was retained in the uterus, while the trunk in the unruptured membranes lay in the abdominal cavity. In this the case resembled No.12 under review. Again, however, no protective sac had been formed although all the evidence pointed to the fact that the opening in the uterus had existed from before conception or very soon after. The ovum had developed largely outside the uterus. The membranes in this case were not unusually thick or tough and the foetal sac could be palpated as a cyst like mass which changed in shape and position as the patient moved. The abdomen was unusually sensitive to pressure.

Diagnosis in this case was not so easy, as the presenting head made the vaginal examination of less value, - as in the case of No.12.

Other cases having one or other point of analogy might be quoted, but sufficient has been written to show that the case under review was one of unusual interest and one that was worth describing in some detail.

We/

We will now proceed with an analysis of all cases of complete rupture of the uterus in the Maternity Hospital during the twenty-five years period - June 1894 to June 1919.

Frequency.

There have been 12 cases of complete rupture of the uterus recorded in the books of this Hospital during the above period.

Of these only 3 occurred in the hospital, the other 9 being admitted for treatment after rupture had taken place. During the same period there have been 12,194 confinements in the hospital, or 1 rupture to every 1016 cases. Comparisons as to the frequency of rupture of the uterus are not at all satisfactory, particularly if cases of incomplete rupture are included. Unless post-mortem examinations have been made, many cases of the latter must pass unrecognised, death being attributed to causes such as shock, haemorrhage, etc. Also in many cases the symptoms are probably more or less slight, and the patient recovers without a diagnosis being made.

In the Bulletin of the lying in Hospital of New York[11] Lobenstine reports 46 cases of complete, and 29 of incomplete rupture of the uterus in 60,000 labours. This works out at 1 in 800 complete and incomplete,/

incomplete, or taking complete ruptures only, to 1 in 1304. The Moscow Clinic figures were given as 1 in 956.

Blacker[12] in the Lancet, reviews the cases of rupture of the uterus that have occurred in the External Maternity Department of University College Hospital during 18 years from 1894 to 1911. In a total of 33,781 confinements there were 8 cases of ruptured uterus, a frequency of 1 in 4222.

Other figures vary widely from Lusks 1 in 6000 to 1 in 462 given by Knoblauch.

Such wide variations show that little value can be placed on statistics collected from hospitals. The probable explanation lies in the fact that most of the cases are sent in already ruptured or threatening rupture. Either these should not be included in the hospital figures or else all outside confinements should be added to the total hospital confinements. If only those cases were included in which rupture actually took place in the hospital, our figures would be 1 in 4,065.

The only way of getting correct statistics would be by including all the confinements and all the ruptures that occur in any one district over a period, irrespective of whether they were treated in hospitals or at home. Of the 12 cases under review 6 occurred

more/

ANALYSIS OF CASES.

Case No.	Date of Rupture	Age	No. of Pgs	Time of Rupture	Before or After Admis^{n}	Site of Rupture	Cause of Rupture	Treatment.	Result.
1. Mrs L.	1895	37	13	Labour	Before	?	?	?	Recovery.
2. Mrs M.	1901	39	7	Preg. 6th M.	Before	Cervix & Lower Uterine Segment	Manual Manipulation	Packed with Gauze	Recovery.
3. Mrs W.	1903	39	9	Labour	Before	Junction of L.U.S & Body.	Hydro-cephalus	do.	Death.
4. Mrs B.	1907	32	7	Labour	After	Cervix & Lower Uterine Segment	Impacted Breech	Hyster-ectomy	do.
5. Mrs A.	1911	31	1	Preg. 4th M.	Before	Cervix & Body	Manual Manipulations	do. (Vaginal)	Recovery.
6. Mrs W.	1914	29	4	Labour	Before	Junction of L.U.S. & Body	Trans-verse Present-ation	Hyster-ectomy	Death.
7. Mrs T.	1917	23	1	Labour	Before	Cervix & Lower Uterine Segment	Forceps	Packed with Gauze	Death.
8. Mrs R.	1917	28	3	Preg. 5th M.	After	Cervix & Lower part of Body	Manual Manipu-lations	do.	Death.
9. Mrs B.	1918	28	3	Labour	After	Cervix, L.U.S. & Body.	Impacted Breech.	do.	Death.
10. Mrs F.	1918	34	3	Labour	Before	Lower Uterine Segment	Forceps	Hyster-ectomy	Death.
11. Mrs S.	1918	37	2	Labour	Before	Cervix & Lower Uterine Segment	Forceps	Packed with Gauze.	Death.
12. Mrs K.	1919	34	9	Preg. 9th M.	Before	Body Anterior Wall.	Trauma & Degener-ation.	Hyster-ectomy	Death.

more or less regularly spaced over the 22 years between 1894 and 1916 while the remaining 6 have occurred within the last 3 years. It is perhaps legitimate to assume that the shortage of civil practitioners during these later years of the War was in some measure responsible for the increase.

An analysis has been made from available data and the results put down in the accompanying table.

It will be seen that 10 out of the 12 cases were multipara - i.e. a proportion of 5 multipara to 1 primipara. Bandls figures were 8:1, Winckels 7:1. Telfair[13] accounts for the disproportion in part at any rate, by the greater frequency in multipara of malpresentations, oversize babies, twin pregnancies and resulting operative deliveries.

A short description of the 11 remaining cases will now be given and discussed in detail, the outstanding features of each case being brought out and comparisons made with the literature on the subject.

On some of the earlier cases very little can be said, the details recorded being meagre. This especially applies to

Case I. Mrs L. who was sent in with a ruptured uterus and who recovered, but no details suggesting the cause of rupture, or giving the treatment carried out are to be found among the records.

Case II. Mrs M. Though full details of this case are not given, it is of interest as being one of the three cases in which rupture occurred during pregnancy. It is also evident that the accident was caused by manual interference in a uterus 6 months pregnant. The body of the foetus had been separated from the head before the patient was sent into hospital. It is not stated whether the foetus was macerated. After admission the head was removed from the uterus and a large rent discovered in the cervix and lower part of the uterus on the right side. Evidently during manipulations a hand or forceps were introduced into the uterus, - probably with an insufficiently dilated cervix which gave way, and the tear thus begun spread upwards. The patient had had 6 previous pregnancies but no reference has been made to these, and we cannot say whether they had any bearing on the rupture. Treatment consisted in packing with iodoform gauze and the patient made a good recovery.

Case III. Mrs W. Aet 39. Para 9. All her previous labours were normal and required no interference. The patient was an alcoholic and had been drunk for a week/

week before she was sent in to hospital. She had been in labour several days before a doctor saw her and sent her in to hospital in a cab. Pains were very severe on the way up, and before she reached hospital she seems to have had classical symptoms of rupture of the uterus, - i.e. during a very bad pain she felt something give way inside and all pains immediately ceased. She arrived in a semi collapsed condition though there had been no external bleeding. In spite of this she managed to walk up the steps from the cab to the second floor before she finally collapsed.

Rupture was not diagnosed by external examination, but per vaginam a hydrocephalic head was found presenting at the brim. This was perforated and the foetus delivered with a cranioclast. It was then found that the uterus was ruptured - a large tear extending round the anterior wall at the junction of the lower uterine segment and the body. There was very little blood in the abdominal cavity.

This is an example of an extensive tear from which there was practically no haemorrhage. The rent was packed with iodoform gauze, but the patient died an hour later from shock.

If the doctor had recognised the symptoms of impending rupture and perforated the head with a pair of scissors or any other sharp instrument before sending/

sending her to hospital it is possible that rupture would not have taken place.

Case IV. Mrs B. Aet. 32. Para 7. History of previous pregnancies. All six were dead born children. The 5th was a breech and labour came on at the 34th week. Perforation of the aftercoming head had to be done. In the 6th pregnancy labour began again at the 7th month and craniotomy had to be done. The diag. conjugate was $2\frac{3}{4}$". At the last pregnancy she had strong pains for some hours until she was sent into hospital, when the pains practically ceased. There was an excess of liquor amnii which obscured the foetal parts, but the uterus seemed to be in a state of tonic contraction. There was no Bandl's ring. Like the 5th this was a breech presentation, and soon after the membranes were ruptured the body was born, leaving the aftercoming head stuck at the brim. It was decided to perforate, but before this could be done, a "swelling" spread from the pubis upwards, and outwards "like a wave," and immediately afterwards the uterus could be felt contracted and to one side of the head. There was no symptom of shock, and the pulse rate did not alter at the time at which the rupture presumably took place. The head was perforated and removed with difficulty and the/

the tear was found to extend upwards and outwards to the left side. The abdomen was gradually distending with blood, and as instruments for abdominal section were not at that time available in the hospital, there was considerable delay while they were being borrowed from the infirmary. A supra vaginal hysterectomy was performed and the stump of the cervix covered with peritoneum, but the bleeding had been severe and the patient never rallied. She died a few days later from general peritonitis.

The previous craniotomy was probably responsible for lacerations which would predispose the passages to rupture. As the rupture did not take place until after the body had been born, and as there was no tonic contraction or Bandl's ring present, it seems obvious that the rupture was caused by the after-coming head coming through a cervix that had not been sufficiently dilated by the breech. The cervix would probably be oedematous from pressure against the brim of the pelvis. The tear once started ran up into the lower uterine segment. It was especially noted that at the time of rupture there was no increase in pulse rate and no immediate symptoms of shock, - a not uncommon experience in cases of this kind.

Case V. Mrs A. Aet 31. Primipara. Nearly 4 months pregnant. She had had slight haemorrhages at intervals of a few days for the first three months. After an interval of three weeks, bleeding and pains in the back began again.

She was seen by a medical man during the day and a midwife was in attendance. At midnight she was delivered under chloroform of a dead foetus. Two days later she had rigors and was examined under chloroform by the doctor who then sent her up to hospital with a diagnosis of "retained placenta".

On admission: Pulse 100. Temperature 98°.
Fundus felt 2½" above the brim.
Patient was pale and very ill.

Vaginal examination:

The cervix was found to be ribboned anteriorly and posteriorly. It was sloughing and there was a foul smelling discharge. There was a tear extending up the posterior wall of the uterus and opening into the pouch of Douglas. Another tear extended 3" up the anterior wall of the uterus, entering the peritoneal cavity near the lateral attachment of the broad ligament. The greater part of the placenta was still in the uterus.

Operation:

A vaginal hysterectomy was done because of the local septic condition. It was successful and the patient discharged six weeks later. Pulse and temperature remained elevated for 25 days.

The less said about a case of this kind the better, except to drive home the dangers that attend interference with a pregnant uterus, and to emphasize the precautions that should be observed when such has to be undertaken. It is not possible to say whether the lacerations occurred when the foetus was delivered or several days after when attempts were made to remove the placenta whose retention seems to have been ignored until sepsis was well established. If the uterus became septic at the original operation the risks that attended interference several days later would be greatly increased, and it would take extraordinarily little manipulation to ribbon a cervix that was oedematous and already inclined to slough. The really remarkable point about this case was the fact that the patient recovered after a vaginal hysterectomy had been done. The vaginal route was chosen because of the septic condition of the patient. There were two large tears opening into the peritoneal cavity. The whole vaginal and uterine tract was intensely septic, so that the woman's/

woman's power of resistance must have been remarkable.

In obstetrical operations the personal equation has more to do with the patient's progress than in any other class of operative work. Absolute asepsis is practically impossible whatever precautions are adopted. In hospital where equally rigid aseptic or antiseptic precautions are taken for all cases, the truth of this statement is being constantly brought home to the obstetrician.

Case VI. Mrs W. Aet 29. Para 4.

Previous confinements normal and easy.

A midwife attended her for 4th confinement and there was doubt as to how long she had been in labour before a doctor was called in. He found a transverse presentation and the uterus already ruptured.

When admitted to hospital the patient did not seem to be much collapsed, but she was under morphia. Temperature 98° and Pulse 70, of good volume and regular. There were no signs or symptoms of haemorrhage. Two hands were projecting from the vulva.

The uterus was firmly contracted down on the foetus. A definite band was felt above the pubis and an area of emphysema above this. The uterus was not tender, but the patient was under the influence of/

of morphia.

Per vaginam - the os was almost fully dilated and a shoulder impacted.

Operation:

Decapitation with a blunt hook was done after considerable difficulty, the body delivered first and the head removed with forceps. It was then found that the lower uterine segment had been torn circularly, the body of the uterus being almost separated from the cervix. The abdomen was then opened and it was found that excepting at one small area, the rupture had extended through the muscle wall only, and did not include the peritoneum. Both broad ligaments were distended with blood, and there was a great effusion of blood on the posterior abdominal wall behind the peritoneum. The uterus was removed at the level of the tear and the stump covered with peritoneum after as much blood as possible had been swabbed away.

Result.

The patient recovered from the immediate shock of the operation but died a few days later of peritonitis.

This is the only case of rupture due to transverse presentation in our list. Like several of the others the patient did not show immediate signs of shock or haemorrhage. The foetus was still in utero and/

and diagnosis of rupture by the doctor outside must have been made from vaginal examination. There had evidently been a considerable amount of bruising of the lower uterine segment round the brim of the pelvis. Johnson[14] says that where there has been bad bruising of the tissues the rupture may be oval or circular, and this is a case in point. The presence of an emphysematous patch in the abdominal wall is interesting and seems to have been only rarely reported.. Whitridge Williams[32] states that in a certain number of cases emphysematous crackling can be got in the tissues of the anterior abdominal wall. He is of opinion that it is probably due to the invasion of the subperitoneal connective tissue by Bacillus Aerogenes capsulatis.

Case VII. Mrs T. Aet 23. Primipara.
Hardly any particulars of this case are given.

The patient was delivered outside, - evidently forceps were used - of a 8¾ lb baby, and she was sent in with a diagnosis of ruptured uterus. The cervix and lower uterine segment were found to be badly torn and lacerated. After douching the uterus and vagina were packed with iodoform gauze. The patient died four days later from peritonitis.

This/

This seems to belong to the class of case previously described, - i.e. injudicious manipulation, - forceps in this case, - causing cervical tears which spread upwards, and opened into the peritoneal cavity. This is probably the most common type of case hospitals have to deal with.

Case VIII. Mrs R. Aet. 28. Para 3.
Patient had had several haemorrhages before she came into hospital in her 5th month. She had not had any previous miscarriages.

The vagina was packed and some hours later the packing was removed and the os found to be dilated to admit three fingers.

The house surgeon turned and delivered and a severe haemorrhage immediately followed. Efforts to stop this were unsuccessful and the patient died on the table.

At the post-mortem it was found that a laceration of the cervix had run up into the lower uterine segment and had involved the uterine artery.

This is another example of the danger of introducing a hand or even several fingers into a pregnant uterus when the os is not sufficiently dilated. Either the hand in the efforts to grasp the foetus, or the foetus during extraction, started a tear in/

in the cervix which spread up, and in its course severed one of the uterine arteries.

Case IX. Mrs B. Aet 28. Para 3.
There was no history of previous difficult labours.

She had been in labour for some time outside, and was sent into hospital in a semi collapsed condition. The uterus had been in tonic contraction for some hours, but on arrival this had passed off, and she was apparently suffering from secondary uterine inertia. It was a breech presentation with extended legs and the body was impacted in the pelvis. A leg was brought down and the foetus slowly extracted. Great difficulty was experienced in pushing the head through the brim and a severe haemorrhage followed the birth. The foetus which was dead weighed 7 lbs 8 oz. A tear was found in the cervix which extended into the lower uterine segment and body of the uterus.

The uterus was packed but the patient died two hours later from intraperitoneal haemorrhage. There had been no history of symptoms suggesting actual rupture before she left home. If the os had not been well dilated by the breech, vigorous pushing would be liable to tear the cervix, and this is probably what happened.

Case X. Mrs F. Aet. 34. Para 3.

No history of her previous two confinements is given. Her third labour was tedious and six hours before she was sent into hospital forceps had been applied unsuccessfully, but whether the difficulty was due to a contracted pelvis or to a large foetus is not recorded. When she was admitted she had many of the classical signs and symptoms of rupture of the uterus. Externally the abdomen was tender, the foetal parts could be very easily felt, and the uterus small and hard, lay to one side of the foetus. Vaginally the head could just be felt high up and freely movable, and there was a free oozing of blood from the vagina. Laparotomy was carried out at once and the foetus and placenta were found among the intestines. The anterior part of the cervix was almost completely severed from the rest of the uterus.

Hysterectomy was performed and the patient lived 12 days but finally succumbed to general peritonitis, after raising everyone's hopes that she would recover.

Case XI. Mrs S. Aet. 37. Para 2.

No history given of her first confinement. The pelvis was contracted and attempts to deliver with forceps outside had been unsuccessful. The cervix was badly lacerated, and/

and when admitted no further attempts were made with forceps. Craniotomy was done and a 8¾ lb foetus delivered.

It was then found that a cervical laceration extended into the lower uterine segment. The rent was packed but the patient died three days later from peritonitis.

It is possible that the immediate cause of rupture was the passage of the foetal shoulders through the cervix that had been torn before admission. Whether it was this, or whether the damage had been completed before she was sent in, does not really matter, - the primary cause of the accident was the forceps.

Cases 7, 10 and 11 have very similar histories and all ended in disaster. Forceps had been unsuccessfully tried outside and the patient sent in to hospital with the damage already done. In all three the cervix was badly torn and lacerations extended into the lower uterine segment. Case 11 would seem to have been an almost hopeless case for forceps as the result proved, for not only was the pelvis contracted but the child was above the average size - 8¾ lbs.

The practice of persevering with forceps in such a case after one or two trials have failed, cannot be too strongly condemned. If after long

and/

and exhausting efforts the foetus is delivered without the supreme disaster of rupture of the uterus, bad cervical tears, fistulas and the like are almost certain to accompany or follow the operation, and in addition to this bad head injuries to the child, - if it survives, - are likely to be present. Before forceps are applied at all it should be ascertained whether the head is in a favourable position; and if not this should first be remedied, - i.e. occipito posterior positions should be rotated, either to the occipito anterior, or transverse (in flat pelves) position, and the forceps then applied. It is a very common experience in hospital even to-day, to find that unsuccessful forceps cases sent in are in occipito posterior positions. Simple rotation of the head and shoulders of the foetus often enables it to be easily delivered with forceps, and even in some cases the labour is allowed to proceed and delivery takes place without further assistance.

COMMENTARY ON PRECEDING CASES.

Age at which rupture occurred.

In most cases the patient was over 30 years of age. Only one was under 28. This was No.7, a primipara on whom forceps had been used and the uterus ruptured before she was admitted. The fact that the majority of cases occur in older women is dependent on the question of multiparity, and the reasons that apply for the one will also hold in the other. Eight cases occurred in labour and four in pregnancy.

The mortality among these cases was rather above the average, i.e. 75%. Published figures of mortality vary between 40% and 70%, according to whether incomplete cases are included. It must be remembered that many of our cases were admitted in the last stages of exhaustion when little could be done in the way of treatment.

Treatment.

There is no record of the treatment adopted in the earliest case, but of the remaining 11 cases hysterectomy was performed in 5 and in the other 6 packing with iodoform gauze was all that was done in the way of local treatment. Of the hysterectomies, one was vaginal, and this case recovered. There does not seem to have been any definite change in the line/

line of treatment adopted, as both simple packing and removal of the uterus have alternated during the 25 years and the results have been equally disappointing, since only one case recovered in each method.

Site of Rupture.

In 7 cases the rupture began with a tear of the cervix which spread up to the lower uterine segment. Of these, 3 were caused by manual manipulations in efforts to clear out the uterus in the middle months of pregnancy.

Of the remaining 5 cases, the lower uterine segment alone was involved in 3, (2 of these being spontaneous ruptures), the body of the uterus alone in 1, and 1 was unrecorded. While it would not be worth giving the above figures in percentages, the following statistics may be quoted as of general interest. Ivask[17] states that during pregnancy rupture of the body of the uterus occurs in 68% and of the cervix in 32% cases.

During labour the rupture percentages are:-

Cervix	55.5%
Fundus	8.5%
Body of Uterus	36.0%

Davis says that the rupture during labour involves the cervix and lower uterine segment in 53.8% cases. In our cases this figure would be 57%.

Causes.

Lobenstine[11] in dealing with the Etiology of Complete Rupture of the Uterus, tabulates the Causes as under:-

1. Spontaneous Rupture
   Pelvic Contraction, Scar of Caesarean Section, Transverse presentations, etc.
2. Traumatic Rupture
   Forceps, Internal Version Accouchment force, etc.
3. Rupture due to combination of Transverse presentation and Internal version.

No.3 seems an unnecessary elaboration as it might easily have been included in Nos1&2. No differentiation between ruptures occurring during pregnancy and those during labour is made, and from a practical point of view this is an important consideration.

With this in view it may be more convenient to divide the cases according to the time at which rupture occurred - following Munro Kerr[2] :-

1. Rupture occurring during Pregnancy
2. " " " early labour
3. " " " late "

Sullivan/

Sullivan[16] in American Journal of Obstetrics, adopts the following classifications:-

A. Traumatic Rupture occurring in Pregnancy,
Falls, perforation by instruments, etc.

B. Rupture during labour
1. Changes in Uterine Wall
2. Obstruction to passenger.

Strictly speaking, labour may come on at any period during pregnancy - in abortions and premature labours, but it will be simpler to make the division at full term and place all those cases occurring before this under one heading, and those that have gone to term under another.

As it would not be very satisfactory to make any division between early and late labours from past records, the following classification of the cases under review may serve:-

I. During Pregnancy.	
(a) Spontaneous Rupture	0
(b) Traumatic Rupture	
1. Manual Manipulation	3
2. Direct Injury	1
Carry forward	4

II./

Carry forward	4
II. During labour	
(a) Spontaneous Rupture	
1. Hydrocephalus	1
2. Impacted breech	2
(b) Traumatic Rupture	
1. Contracted Pelvis	
Forceps	3
2. Transverse Presentation	1
Unrecorded	1
Total	12

That there is considerable risk of rupture from manipulations of the pregnant uterus during the earlier months, and before the foetus has attained a large size, is illustrated by cases 2, 5 and 8, which were all cases of rupture from manipulation during the 6th, and 5th, and 4th months respectively. Why a version should have been necessary during the 5th month is not made clear in the notes on the case, but apparently a hand was introduced into the uterus and the cervix gave way. In the three cases the lower uterine segment was the site of rupture and it is probable that in each case the operation was attempted with an insufficiently dilated cervix, and that a laceration commencing in the latter spread up into/

into the uterus. The earlier cases are more obscure as the rupture occurred before the patient came into hospital, but there must have been much interference as in one the body of the foetus had been pulled (or cut) away, and the head remained in utero. Of course if the foetus was a badly macerated one it might not require a great amount of exercise to dismember it, but further efforts to remove the head would certainly have been made before it was given up and sent in to hospital.

In many of the cases no history can be discovered of previous operative interference such as Caesarean section, Curettage, Manual removal of placenta, Craniotomy, etc., any one of which may have predisposed towards rupture in a future pregnancy or labour, by the formation of fibrous tissue and consequent weakening of the uterine wall. In such a case as No.12 it would be of the greatest assistance in deciding the cause of rupture if such a predisposition could be found, but all inquiries failed to do so. In spite of this, however, the microscopic examinations showed that marked changes had taken place in the uterine wall, and that such changes must have been in part to blame for the rupture. In all the other cases, - with the exception of No.1, of which no details are available, - there had either been interference resulting/

resulting in immediate rupture, or else there was some condition present, such as neglected hydrocephalus, or transverse presentation, which left no doubt as to the immediate cause, apart from any predisposition that may have been present.

Repeated Rupture.

There is no case of repeated rupture in the list. Becker[15] collected 27 cases of repeated spontaneous rupture of the uterus, and quoted one of his own in a primipara who recovered under conservative treatment, consisting of tamponade of the organ. The fact that comparatively few cases of repeated rupture are recorded, must be due to the high mortality that occurs in all cases of ruptured uterus, for to the original predisposition that was the decisive factor in the first rupture, and which in most cases would still remain after recovery, must be added the presence of the healed tear in the uterine wall. The wound would heal by granulation and the formation of scar tissue, and as no stitches are used when conservative methods are carried out, the junction is likely to be a weak one.

It thus becomes a matter of extreme importance that a patient who recovers from a rupture should be warned of the risks of another pregnancy, and should be urged to place herself early under medical supervision/

supervision should such a contingency arise.

It is unfortunate that even in those cases in which hysterectomy was performed, microscopical examination of the uterine tissue was only carried out in case No.12, who was admitted to hospital with rupture of the uterus in April of this year. Häfner[18] discussing the mechanism and etiology of spontaneous rupture of the uterus during labour, concludes that though mechanical factors generally are the most important, even slight changes in the uterine tissue are factors which should be given due consideration. He urges that an exact histological examination of the uterine wall should be made as soon as possible after the rupture in every case in which operation or post-mortem examination is carried out. He says, however, that only serious pathological changes have decisive value.

Sections should be made at the site of rupture and also from other parts of the uterus. These should be examined for evidences of local or general degeneration, and also for evidences of previous injury, shown by the presence of excess fibrous tissue, etc.

It is of course a well established fact that any kind of lesion in the passages lays a patient open to the possibility of a rupture in future pregnancies. The literature of the last couple of decades, and more especially/

especially since Munro Kerr's article on Rupture of the Uterus in the Journal of Obstetrics and Gynecology Vol. XIV - bristles with references and cases bearing on this problem.

Caesarean Section.

More recently the question of the responsibility to be shared by Caesarean Section in this connection has been taken up. In the United States especially a good deal of criticism has been levelled at the increasing popularity of this operation, many holding that it is being carried out with unnecessary frequency, and that many cases of rupture during subsequent pregnancies follow this operation.

A.B. Davis[10] describes two cases in which rupture followed Caesarean section and the second of these was of especial interest. It is important to note that the patient had run a temperature for five or six days after the original operation. This case has already been referred to, and at present it is enough to say that two years later when the abdomen was opened for a second Caesarean, the foetus was found lying in the bag of membranes free in the peritoneal cavity, and all the evidence pointed to the fact that the opening in the uterine wall was along the old Caesarean scar, and that this had been open from before conception or very soon after.

During/

During the entire pregnancy the ovum had developed largely outside the uterine cavity.

Oastler[19] in the same journal quotes a case of his own in which the old Caesarean scar failed to stand the strain placed on it during the later months of pregnancy. In this case also sepsis had occurred after the original operation and the patient had also developed Phlegmasia.

Without detailing more individual cases it will be sufficient to note that the American journals are full of such, and that the majority of the cases quoted have a history of more or less sepsis after the first operation.

Novak[20], reporting a case which had a slight fever for a few days after the section, gives it as his opinion that uterine rupture after Caesarean section practically never occurs when convalescence from the Caesarean operation has been entirely normal - i.e. there has been no evidence of infection of a uterine scar. Many others hold this view.
On the other hand Sullivan[16] states that recent articles seem to prove that there is a marked tendency to rupture of a uterine scar in subsequent labours. He quotes as a conservative estimate that it occurs in 3% of cases, and of these, 50% result in the death of the mother, and 80% in the death of the foetus.

He/

He argues that this 1½% of deaths due to rupture, and indirectly caused by Caesarean section, should be added to the 5% risks allowed for this operation. He goes on to say that in the great majority of cases the rupture occurs in the scar itself, and is due to the fact that proper healing is interfered with by uterine contractions and also to the presence of low grade sepsis which frequently follows Caesarean section. The placenta also is accused of a liability to attach itself to the area of the scar, and the penetration of the chorionic villi into the wall of the uterus causes a local weakening.

Sullivan is emphatic in his opinion, after a review of the literature of the last few years on the subject, that Caesarean section is being carried out with unnecessary frequency, and that its use should be confined to urgent emergencies and to those cases where more conservative measures are out of the question.

In this country much less is made of the dangers of rupture following Caesarean section, and the cases published are few and far between.

Hastings Tweedy[23], Master of the Rotunda Hospital, Dublin, is of opinion that there is no fear whatever of Rupture of an old Caesarean scar, if the operation has been properly performed. If this is correct, there is room for improvement in American practice, judging/

judging from the considerable number of cases published in their journals.

Tennyson Smith[22] describes a case of his own where no history of sepsis could be obtained but could not be absolutely excluded. Caesarean section had been done six years before for contracted pelvis and there had been no complications during recovery. She had been in supposed labour for fourteen days before a doctor was called, and by the time he arrived the woman was collapsed and the diagnosis clear. The dead foetus and the placenta were free in the peritoneal cavity and the uterus had ruptured along the old Caesarean scar. The placental site was not given, which is to be regretted for it may have considerable influence in determining rupture.

In many cases - perhaps in the majority - recorded, in which a Caesarean scar has reopened, the placenta was attached to the anterior wall in the original operation and had to be cut through before the child could be delivered. It may be that the increased vascularity and bleeding that is present in such cases gives rise to a weaker union. If in addition to this the placenta in a subsequent pregnancy overlaps the old scar, the danger of rupture would be increased.

In the Lancet, W.K. Walls[24] describes two cases of rupture of old Caesarean scars. In neither was there/

there any mention made of sepsis after the original operation. The first case was a woman aged 30 who had had three previous Caesarean sections. She had a sudden collapse with severe abdominal pain about her 7th month, and at the operation it was found that the scar had only just begun to give way at the top, and the bleeding from this had filled the peritoneal cavity. A hysterectomy was done but the patient died.

The second case had had one previous Caesarean and was within ten days of full term. She developed symptoms suggesting concealed accidental haemorrhage. When the abdomen was opened much blood was found in the peritoneal cavity, and blood was oozing from the bottom of the old scar in the uterus, but though broad and much thinned out the scar still held excepting at the one point.

A supra-vaginal hysterectomy was done and the patient recovered.

Yet another case may be quoted in which the old scar opened and in which the foetus and placenta remained in utero.

Fletcher Shaw[25], in the same volume of the Lancet, gives notes on a case at full term who had had one previous Caesarean. There is no mention of sepsis/

sepsis during the puerperium following this operation. A week before full term she had severe abdominal pains and six hours later she walked to hospital and arrived in a collapsed condition. She had severe pain and tenderness in the mid line of the abdomen.

It was found on opening the abdomen that the old Caesarean scar had completely opened up, the placenta was on the anterior surface of the uterine wall and plugged the wound. The abdominal cavity was filled with blood. She recovered after a supra vaginal hysterectomy.

All three of the above cases illustrate the danger of confusing concealed accidental haemorrhage in an intact uterus, with certain types of rupture of the uterus. A uterine scar may give way gradually, and the foetus remain in utero and none of the symptoms of a dramatic collapse be presented. Walls' two cases especially illustrate how quietly rupture may begin, and haemorrhage into the peritoneal cavity take place while the scar is still almost intact. In both, abdominal pain and tenderness would probably be present and there may be no external haemorrhage. None of the signs presented when the foetus, or part of it, escapes from the uterus would be present, and unless free fluid was searched for and was present in sufficient quantity in the abdominal cavity, it might very easily be missed. This would be especially confusing if the uterus was large and contained a lot of liquor amnii. The danger lies in the fact that temporising in the case of rupture might be fatal.

A vaginal examination would not be of much assistance as some part of the foetus would present at the os, and blood on the examining finger might be seen in either condition. Statham[26], in the Lancet, describes a case of spontaneous rupture of the uterus at the 8th month. This was at first thought to be a case of concealed accidental haemorrhage but a laparotomy revealed extensive rupture, and the foetus was lying free in the peritoneal cavity. Munro Kerr[2] describes a case of his own of spontaneous rupture through the cicatrix of a Caesarean section, in which rupture occurred in the Maternity Hospital when the patient was lying in bed. She had some abdominal pains which were taken for uterine contractions of oncoming labour. Later symptoms became more pronounced and operation revealed the rupture and a dead foetus and placenta free in the abdominal cavity. The patient recovered after hysterectomy.

How many Caesarean sections should be done on the same patient before sterilising her, or whether we are justified in sterilising at all are debatable questions. The general opinion among Edinburgh obstetricians seems to be that sterilising is justified at the second operation. From the point of view of possible rupture in future pregnancies it is obvious that more scar tissue must be formed with/

with each operation, and Walls' first case quoted, who had had 3, is an example very much to the point. With this risk of possible rupture added to the ordinary risks of the operation, every woman at her second Caesarean should surely be given the option of sterilisation.

Pituitary Extract.

A number of articles have appeared in American journals in late years on the dangers attending the use of pituitary extract during the first and second stages of labour, and here and there cases of rupture have occurred and the cause assigned to this drug.

In case No.12 of our list, a relatively large number of injections of pituitrin, spread over several days, were given in the effort to overcome the supposed uterine inertia.

The question as to whether this had been the cause of the rupture, discovered at the operation, was raised but turned down, as all the evidence pointed to the fact that rupture must have taken place some weeks before she was admitted.

Mundell[27] reported on 1200 cases in which Pituitary extract was used, and among these there were 12 cases of ruptured uterus - i.e. 1%. This seems an extraordinarily high figure and suggests either that the cases chosen were unusually difficult ones and/

and that causes other than the pituitrin were largely responsible, or that the drug was used indiscriminately, and especially during the early second stage. Sullivan[16] considers that the use of pituitary extract is possible only in the second stage of labour, in the absence of disproportion, with the head distending the perineum. He advocates its use only in uterine inertia as an alternative to low forceps delivery, and concludes that pituitrin tends markedly towards rupture of the uterus in labour if used in the early stages, and should never be given until the head is in sight. It has no place in the first stage of labour. Cases of rupture associated with pituitrin are usually latent, and do not show tragic symptoms as sudden shock and collapse. The onset of symptoms is gradual and more akin to many cases of degenerated muscle tissue.

While often used in this country in certain cases of antepartum haemorrhage, etc., when it is desirable to set up uterine contractions, its use is mostly confined to the end of the second stage when there is delay, and after it is certain there is no obstruction in the passages. Cases of rupture which can be put down to pituitrin must be very rare, and there is little reference to the question in current literature.

Previous/

Previous injuries.

Apart from Caesarean section, cicatricial tissue may be formed by any operation involving injury to the maternal passages.

Case 4 of our list had had a craniotomy done at a previous confinement and it is seldom that a difficult operation of this sort when the head is high up, can be completed without a certain amount of bruising or laceration. Previous curettage or manual removal of an adherent placenta might certainly predispose to rupture, though it must be granted that the risk is not great judging from the comparatively large number of such operations and the small percentage of ruptures. However numerous authentic cases may be quoted, and the possibility of future trouble must always be borne in mind. The danger would certainly be greater in those cases that occur now and again in which the curette has perforated the uterine wall. Kerr[3] believes that disease of the uterine wall and probably unrecognised lacerations at previous labours, play a more important part as the cause of rupture of the uterus early in labour, than do obstructive causes. In analysing recorded cases he found there is a surprising frequency/

frequency of previous difficult labours, injuries or disease. Chronic metritis is often mentioned as a possible primary cause of rupture. In case No.12 chronic metritis has been mentioned as the probable cause of the increase of fibrous tissue and decrease of the muscular elements found in the uterine wall. Milne Murray, Kew and many others have described cases that followed curettage. Polak[21] quotes a case of rupture two years after curetting and perforation of the uterus by the instrument. The patient had a severe abdominal crisis but recovered after hysterectomy. Gaus[28] and Brodhead[28] and others, in the same journal also quote many similar cases in which there was a history of curettage with or without perforation several months before pregnancy. Statham's case of spontaneous rupture referred to above, had been curetted a year previously for septic abortion. No other cause of the rupture could be found. Swayne[30] describes a fatal case of spontaneous rupture in a multipara who had been curetted two years previously on account of an incomplete septic abortion. Microscopical examination of the uterine wall at the edge of the laceration was made, but no cicatricial tissue found. Such cases could be multiplied indefinitely and it seems a well established fact that curettage, and especially those/

those cases in which sepsis has been present at the time of, or after, operation, must share in the responsibility of future ruptures.

The same may be said of the manual operation of removing adherent placentas in otherwise normal labours. If sepsis follows there is probably far more cicatricial tissue formed and consequent greater potential weakening of the uterine wall.

Whether the site of the placenta at the time of rupture has such an important influence in determining rupture is another matter. A large number of writers have called attention to the fact that the placenta is frequently situated over the site of rupture. Kerr [2] says that a low implantation of the placenta must be mentioned as a possible cause of rupture, for the chorionic villi under certain conditions may have a specially destructive effect by burrowing unusually deeply into the wall.

Ivanoff reported 130 cases of rupture of the uterus at the placental site. I have not been able to find any very conclusive evidence on this, as little is said about the results of microscopical examination. Such examination is necessary to prove the depth to which placental tissue has burrowed, and until this has been done on a large number/

number of cases the question cannot be cleared up. Some of the cases used as examples give a history of previous injuries or operative interference which alone might have predisposed to rupture. Others have no suggestive influences in their past history, while Long[35] seems to think that the placental explanation is only of importance when it is on the site of former trauma, or on any lesion that heals without leaving a thick normal wall. Such a situation invites invasion by chorionic villi and thus impairs the strength of the uterus. Here again microscopic evidence is needed, for rather than deeply invade the cicatricial tissue of the old lesion the placental tissue may spread more widely over the uterine surface. This it usually does in cases of placenta praevia, as though the thinner lower uterine segment was not sufficiently vascular to supply nourishment to a normal sized placenta, and it has therefore to wander farther afield, the resulting organ being thin and of a large area.

When it is remembered how much of the inner surface of the uterus is covered by a placenta towards the end of pregnancy, it is not to be wondered at that in a fair percentage of cases the rupture involves some part of the placental site, and that fact alone can hardly be adduced as evidence that the placenta was responsible for the accident, or even that it had any deciding influence.

Degeneration.

Fatty and hyaline degeneration of the muscle is often spoken of as a cause of rupture when no other explanation can be found. Here and there the microscope has proved the truth or fallacy of the diagnosis, but in the great majority of cases described in the various journals this appeal has not been made. It is in cases of spontaneous rupture and especially spontaneous rupture during pregnancy which often takes place quietly and symptoms come on insidiously, that such degeneration would be expected. A good many have doubted whether such disease occurs more than very rarely. In case No.12 of our list it was thought that degeneration would be present, but fatty or hyaline changes were not found.

Meyer describes a case with hyaline degeneration of the uterine muscle, and Munro Kerr is of opinion that degeneration of the wall is frequently present and predisposes to the accident, which may be precipitated by a very slight accident such as a fall or even by a cough, or violent movement on the part of the child. Armytage[31] describes a case of spontaneous rupture of the uterus in a Bengali primipara, aged 22, who died a few hours after the onset of great/

great pain with vomiting and collapse. There was no discharge per vaginam and the cervix was not taken up or dilated at all. At the post-mortem it was found that the uterus was quite empty, the foetus and placenta lying in the peritoneal cavity. There had been no history of violence or trauma,- no signs of syphilis, etc.

Microscopic examination of the uterine wall at the site of rupture showed patches of marked hyaline degeneration irregularly distributed. There was infiltration deep in the muscle tissue which was becoming organised into fibrous tissue. Apparently the other organs of the body were not examined to see whether the degeneration was general or confined to the uterus. Nor were the foetal organs examined. The cause of the degeneration was not discovered, but there was no doubt whatever in this case as to the cause of rupture.

An interesting case of spontaneous rupture during the 5th month is described by Oastler[4] in the A. J. of O., the cause of the accident being an inflammatory condition in the uterine wall. She had had several attacks of colic during the 5 months, culminating in an abdominal crisis which suddenly came on as she was descending the steps of her house and/

and she fell to the ground unconscious. A diagnosis of ectopic gestation was made, and a laparotomy was done as soon as possible. Rupture of the uterus at the fundus with the foetus in the abdominal cavity was found. Haemorrhage into the cavity had been severe, and the patient died on the table.

Examination under the microscope showed that there was marked degeneration of the placental elements bordering the perforation and a leucocytic infiltration. The wall itself was extremely oedematous and the muscle fibres widely separated. In one portion the wall was converted into tissue consisting of stellate and spindle cells embedded in a rather hyaline substance. This tissue had newly formed blood vessels some of which were filled with leucocytes. The smooth muscle elements were entirely replaced by this granulation tissue. In the same region the surface of the uterus showed recent inflammatory adhesions. The presence of this granulation tissue, etc., indicated that there had been some local inflammatory condition of the wall. There was no evidence of malignancy. It is of course possible that the case was one of an interstitial ectopic pregnancy, and that this accounted for the changes in the surrounding muscle tissues.

Hilda Shufflebotham[33] in the Lancet described a case of rupture of the upper part of the uterus at/

at full term. Fifteen previous pregnancies had all been normal. Microscopical examination of the uterus showed marked degeneration at the site of rupture, and at the edge the wall was no thicker than a sheet of paper. Lewes Graham in a note on the case says that he has had three cases of ruptured uterus with unruptured membranes and dilated os, and in each case the patient had had a large number of pregnancies in rapid succession. That the uterine wall could give way without rupturing the unsupported membranes at the external os argues that the tension causing the rupture must have been very slight. It necessarily follows that the uterine musculature must have been in a very degenerate condition. On the other hand it is possible that the os dilated after the rupture had taken place. This happened in our case No.12, in which rupture took place some weeks before she was admitted to hospital. Mandach[34] describes a case of spontaneous rupture during normal labour in a para 5, aged 40. After rupture of membranes the pains stopped, and evidences of ruptured uterus prompted laparotomy. The child and placenta were found in the abdominal cavity, having been extruded through a rent in the posterior wall of the lower uterine segment.

Microscopical examination proved that the mucous membrane/

membrane was very thin and that the muscle everywhere presented evidences of advanced hyaline degeneration. The placenta did not show evidence of special disease but the maternal kidneys were affected - parenchymatous nephritis and pyonephrosis.

There is a wide field for investigation into the state of the uterine tissues in all cases of spontaneous rupture during pregnancy and early labour, when mechanical reasons which would account for the accident are not present.

Previous Instrumental Deliveries.

It is well recognised that lacerations at previous pregnancies during instrumental deliveries, craniotomies and so forth, predispose to rupture at a future date. A case in point was recently admitted to the Royal Maternity Hospital in which the patient owing to a slightly contracted pelvis had had 3 previous difficult forceps deliveries. In the present confinement the head was well down in the cavity when the extern doctor was called in. He found the woman in a semi collapsed condition and something seemed to be seriously wrong. He applied forceps without trouble and effected an easy low forceps delivery. The placenta came away without interference. The patient continued to give anxiety and was next day brought into hospital and examined/

examined under an anaesthetic. It was found that there was a longitudinal rupture about 2 inches long in the posterior fornix. There was a good deal of cicatricial tissue about the vagina, - evidently the result of previous lacerations, and in reviewing the case, the conclusion was reached that as the head came down the lower uterine segment became drawn up over it, the vagina was put on the stretch and one of these old scars had given way. In the lower part of the tear the mucous membrane had torn, but in the upper half, the mucous membrane was intact but the tissues beneath had given way, thus forming a tunnel. No opening into the pouch of Douglas could be found and the laceration was packed with iodoform gauze. However she died two days later of peritonitis, and at the post-mortem it was discovered that there was a small perforation into the peritoneal cavity.

A somewhat similar deduction was made in a case described by Reynolds Wilson[36]. This was a woman who had been in labour 4 hours when the head rapidly descended to the vulva, the pains ceased, and the patient became conscious of recession of the head. Diagnosis of rupture was made and the abdomen opened. Foetus and placenta were lying in the abdominal cavity. There was a complete rupture of the lower uterine segment to the right and posteriorly, the opening being practically closed through contraction of/

of the uterus. There was also a rupture in the vaginal vault which was quite independent of the uterine rupture. The cervix was not torn. There was no pelvic contraction and the foetal head was on the pelvic floor at the time of rupture. It was not a long labour, nor was there any interference of any kind. The cause of the rupture was mainly attributed to tissue changes in both vagina and uterus, and secondarily to pendulous belly and improper axis of descent.

Weiss[37] reported a case in which a 5 months foetus was expelled through the anterior portion of the cervix while the external os only admitted two fingers. This was probably caused by an old bruise or laceration giving way. A rigid os might also be a factor in a case of this kind. Freud considered that a rigid os per se may bring about rupture, but there would probably be some other condition present which would predispose to rupture, such as degeneration, old laceration, etc. Eckstein[38] held that spontaneous rupture may at times be traced to old lacerations, injuries or inflammations which have been sufficient to produce scar tissue without symptoms. Lobenstine[11] in describing the mechanism of spontaneous rupture says that it is almost always the result of tonic contraction. The site of rupture/

rupture depends on whether the presenting part has passed the lower uterine segment or not. If the head imprisons the cervix against the pelvic wall, the rupture will take place through uterine tissue. If the lower uterine segment is drawn up over the presenting part, the rupture will take place in the vaginal vault, and may then extend secondarily into the lower uterine segment. In our own case described above, there was a marked predisposition to rupture in the vagina owing to cicatricial tissue, but this did not extend to the uterus.

In the majority of the twelve cases under review the rupture began in the cervix and spread upwards, and this is probably the commonest type of rupture that occurs.

The application of forceps before the cervix is fully dilated still seems to be a fruitful source of cervical tears in general practice. In long difficult labours it is a great temptation to a busy man to hurry matters up by manual dilatation. The distressed patient and her anxious relatives clamour for something to be done, and the doctor himself is only too anxious to get away. Often too, a cervix that was thought to be fully dilated turns out, when a better examination is made with the patient anaesthetised, not to be so, and the temptation to go ahead/

ahead is irresistible. There is a particular danger of bad cervical lacerations in those cases of prolonged labour in which the cervix or part of it has become nipped between the presenting part and the bony rim of the pelvis and becomes oedematous.

Another type is that in which owing to disproportion in size between the passenger and the passages, or to abnormal presentation or position of the former, descent into the pelvis is delayed while the membranes dilate the cervix more or less fully. As soon as the membranes rupture the cervix may partially close up again, and become greatly thickened and soggy, and the gentlest manipulation is liable to cause bad tears of the cervix which may pass up to the lower uterine segment.

SIGNS AND SYMPTOMS.

Apart from Case 12 which has been already fully discussed, there are not any points of outstanding interest about the symptoms present in the cases of our list. The rupture of the uterine artery and its tragic consequences, in Case 8, is fortunately a rare occurrence. It usually escapes rupture probably because it is tortuous and lies in loose tissues, and also because it has tough walls.

Cases/

Cases 3 and 10 both showed classical symptoms, and diagnosis was clear. In the commonest type of rupture - tears of the cervix and lower uterine segment - diagnosis was not made as a rule until after the foetus was delivered, when the vagina was explored. In these ruptures, as also in the hydrocephalus and transverse cases, the foetus remained in utero, and palpation of the abdomen would not have helped much towards diagnosis. In the majority external haemorrhage was not severe and in some cases was absent, but in most of them oozing or free bleeding into the peritoneal cavity took place. In case 6 the haemorrhage took place between the layers of the broad ligament on each side, and spread up the posterior abdominal wall. The patient did not show severe symptoms when she came in, probably because the pressure of the blood between the layers controlled haemorrhage.

In case 10 the uterus was easily felt after rupture as a separate mass well contracted down beside the foetus, - not behind, as in Case 12. It is generally stated that the uterus firmly retracts after rupture but Lobenstine[11] argues that this is not generally the case, and that it is as often as not large and flabby.

C O N C L U S I O N S.

In concluding the commentary on these twelve cases it may be useful to briefly summarise those points which are of most interest. Case No.12 has been already dealt with in detail and the conclusions summarised, and these need not be repeated.

I. General remarks.

The frequency agrees fairly closely with the average figures published from many other hospitals, but as pointed out such figures are not of much value.

Classical text book symptoms were the exception rather than the rule. External haemorrhage was usually absent, and more patients died later from peritonitis than immediately from haemorrhage and shock. Symptoms of immediate shock do not always occur, and are often postponed for some hours. In case 12 there were no definite symptoms until weeks later, when severe haemorrhage was caused by the separation of the placenta.

The possibility that Caesarean section may be a source of danger to subsequent pregnancies, especially when recovery has not been free from sepsis, has been discussed. When Caesarean operation/

operation is not clearly indicated, as for central placenta praevias, in elderly primipara, etc., this future risk should certainly be borne in mind when a decision is to be made.

II. Causes.

If we divide the eleven cases in which we have sufficient details into avoidable and unavoidable, only one, - No.12, - would come under the later category.

Of the other ten cases, four -(Nos. 3, 4, 6 and 9) were all preventible if they had been seen in time by a doctor, as the cause of rupture was obstruction which gave rise to prolonged labour. Taken in time none of these ruptures should have occurred. Three,(Nos. 2, 5 and 8) were caused by manual interference,and three,(Nos. 7, 10 and 11) in attempts to deliver with forceps.

III. Attempts to deliver with forceps before the cervix is fully dilated, or in unsuitable positions of the presenting part. Three cases illustrate this and it must be emphasised that forceps should not be put on with the head in occipito posterior positions, when rotation is still possible. The forceps are very liable to slip and in doing so they may tear the cervix and damage the soft parts. Several cases illustrate the ease with which such tears/

tears may extend to the lower uterine segment.

IV. Interference with the pregnant uterus.

The dangers attending the introduction of a hand, or even several fingers, into a pregnant uterus when the os is not sufficiently dilated have been emphasised and illustrated by three of the cases under review. Great care should be taken lest too much force is being used in efforts to clear out an adherent or retained placenta, version in placenta praevia, etc.

V. Ante-natal Examinations.

Every woman should be examined during the later months of pregnancy by a doctor. Among the well-to-do, who are usually under medical superivision the accident seldom occurs. Among the poor classes in the past, the untrained midwife, who often neglected to call for assistance until too late, was responsible for many cases of rupture, but happily her day is passing and she is being replaced by the properly qualified and trained midwife.

The spread and increasing popularity of the ante-natal clinics will do much in the future towards prevention of bad cases, and version, induction, Caesarean section, etc., will be done in those cases which in the past have, owing to want of supervision of pregnancy, ended in craniotomy, decapitation, or in the supreme disaster of rupture of the uterus.

B I B L I O G R A P H Y.

1. Koetritz. Deutsche Med. Wehnsehr XIV 613.

2. Munro Kerr. Rupture of the Uterus. J. of O. & G. V. XIV. No.1.

3. Campbell. J. of O. & G. Vol. 15, p.403.

4. Oastler. A. J. of O. Vol.77. 1918.

5. Swayne. J. of O. & G. Vol. 23. p.180.

6. Stookes. J. of O. & G. Vol. 22. p.358.

7. Lewes Graham. Lancet. Vol.2. 1917. p.571.

8. Kubacki. Nowing lekarshie 1910 No.7

9. Phillips. Lancet 1909. Vol.1. p.1320.

10. A.B. Davis. A. S. of O. Vol.77. 1918.

11. R.W. Lobenstine. Bull. of lying in Hospital of New York. Vol.VI. No.2.

12. Blacker. Lancet 1912. Vol.1. p.84.

13. Telfair. A. J. of O. Vol. 73. 1910.

14. Johnstone. A Text Book of Midwifery.

15. Becker. Ztschr. f. Geburtsh U. Gynäk. Bd 71 H 1 - 2.

16. Sulliman. A. J. of O. Vol.78. 1918.

17. Trask. A. J. of O. Vol. 73. 1916.

18. Häfner. I. D. Breslaw 1910.

19. Oastler. A. S. of O. Vol. 77.

20. Novak. J. of A.M.A. 1918 LXXI 105.

21. Polak. A. J. of O. Vol. 77. 1918.

22. Tennyson Smith. B.M.J. Vol.2. 1914.

23. Tweedy & Wrench. Practical Obstetrics.

24. Walls. Lancet 1915. Vol.1. p.330.

25. Fletcher Shaw. Lancet 1915 Vol.1.

26. Statham. Lancet 1913 Vol.1. p.248.

27. Mundell. A. S. of O. Vol. 78. 1918.

28. Gaus. A. S. of O. Vol. 69.

29. Brodhead. A. S. of O. Vol. 69.

30. Swayne. J. of O. & G. Vol. 23. p.180.

31. Armytage. J. of O. & G. Bol. 24. p.174.

32. W. Williams. Text Book of Obstetrics.

33. Shufflebotham. Lancet. Vol. 1917.

34. Mandach. A. S. of O. Vol. 73. 1916.

35. Long. A. S. of O. Vol. 70. 1914.

36. Reynolds Wilson A. S. of O. Jan. 1911.

37. Weiss. Zentralblatt f. Gyn. Feb.1903.

38. Eckstein. Zentralblatt f. Gyn. Vol.32 No.29.